AFEP Review

Performance & Results from the Pacific Ocean Shelf Tracking (POST) Array: Testing the Delayed Mortality Hypothesis & Benefits of Transportation

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Gordon and Betty MOORE FOUNDATION *Creating positive outcomes for future generations.*
BPA
CENSUS OF MARINE LIFE
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Outline of Talk

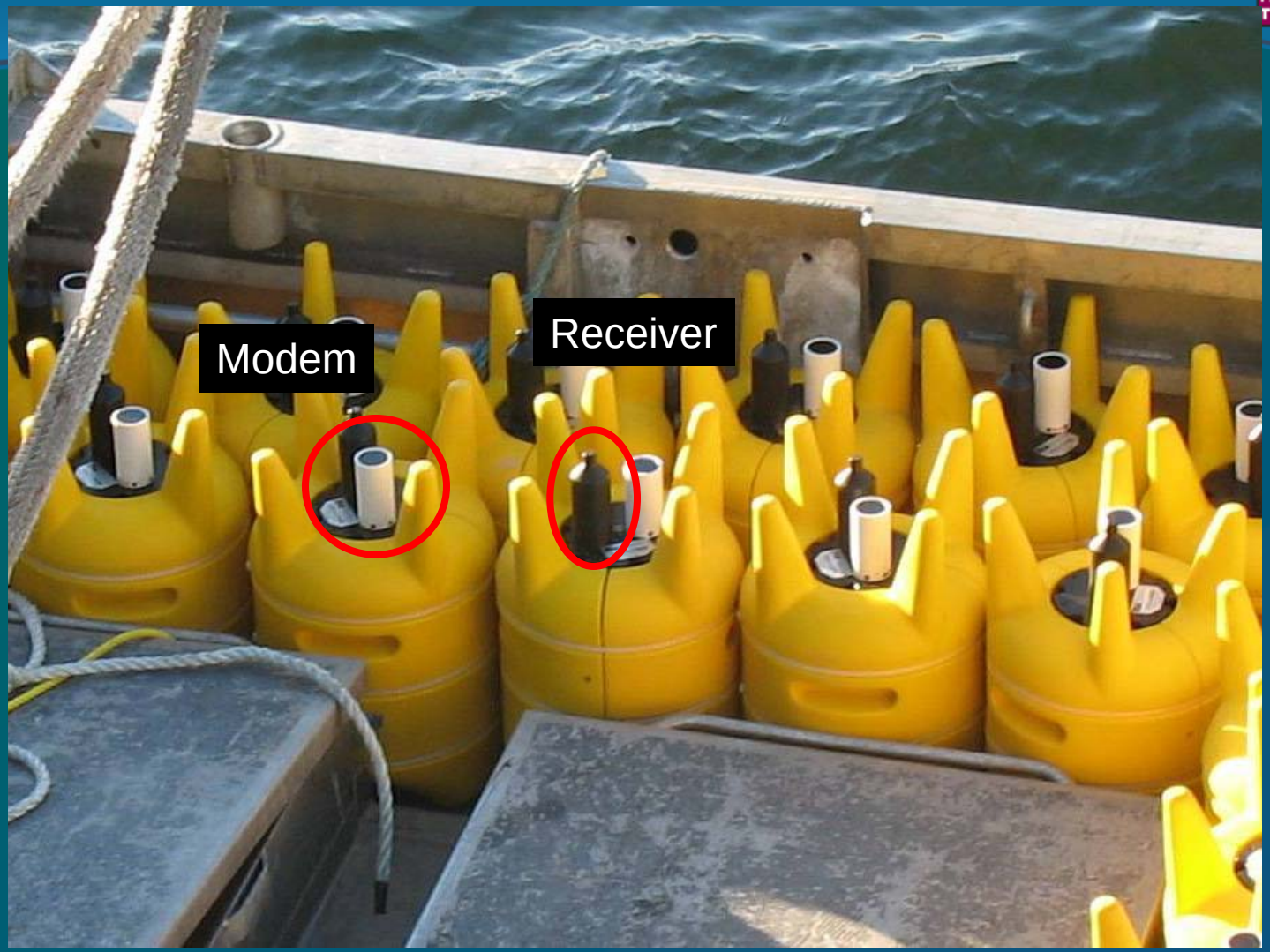
1) Operational Performance:
    a) Detection Efficiency
    b) False Positives
2) Biological Results:
    a) Tag Effects
    b) Differential [Latent] Mortality
    c) Survival Post-Transportation

Goals

1. Establish whether the POST technology will work for Columbia R salmon problems
   - Is the 9mm Vemco acoustic tag "*too big*"?
2. Measure whether differential mortality of Snake R smolts is expressed below Bonneville Dam
3. Measure whether transportation "helps or hinders"
   - Is survival of transported (barged) smolts reduced relative to ROR smolts?
4. Pilot study to establish a tool for addressing Columbia R salmon issues in the ocean

Deployment of Listening Lines- 2004~05

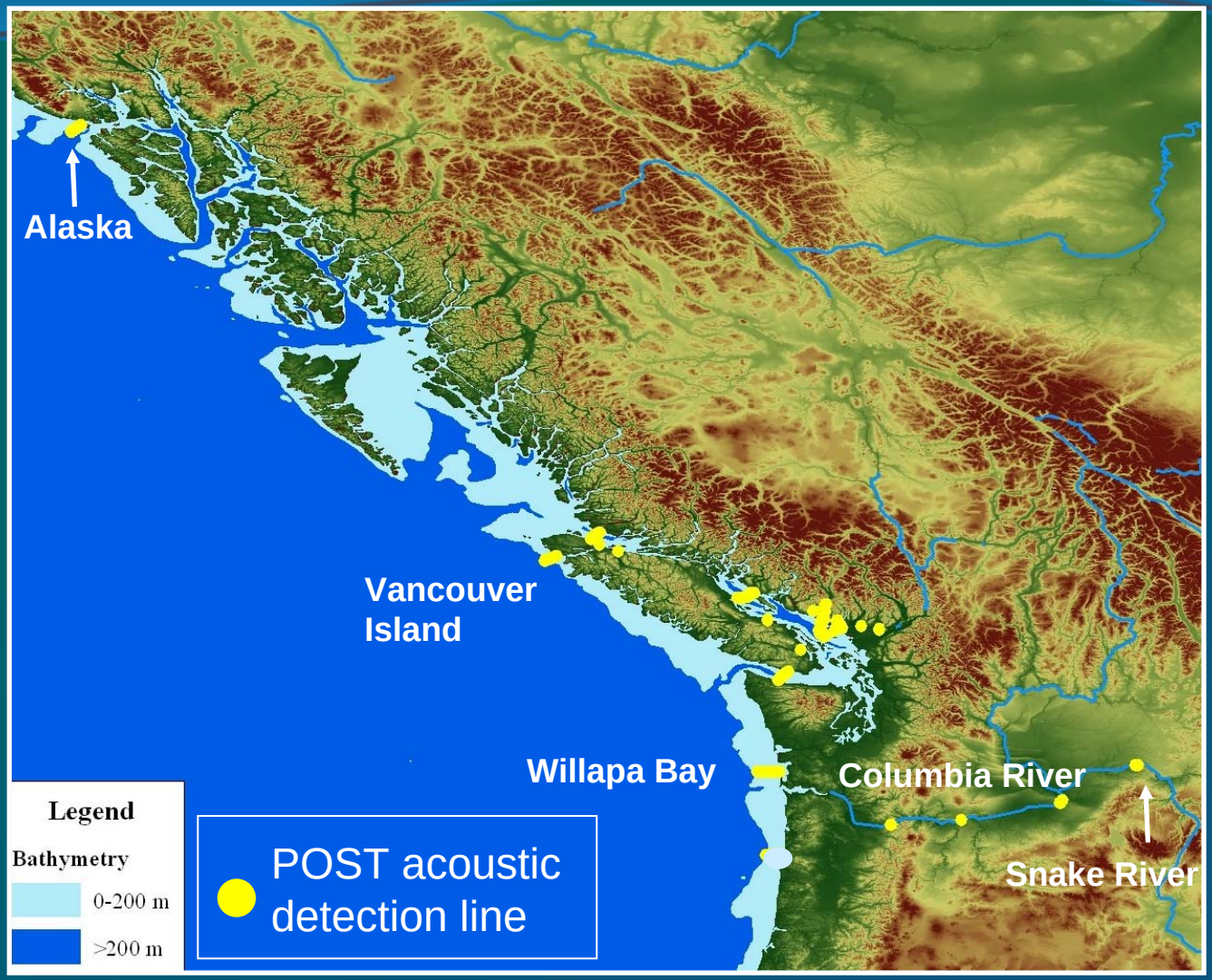
2006: Rollout of POST's Permanent (7yr), Wireless Platform


Modem
Receiver

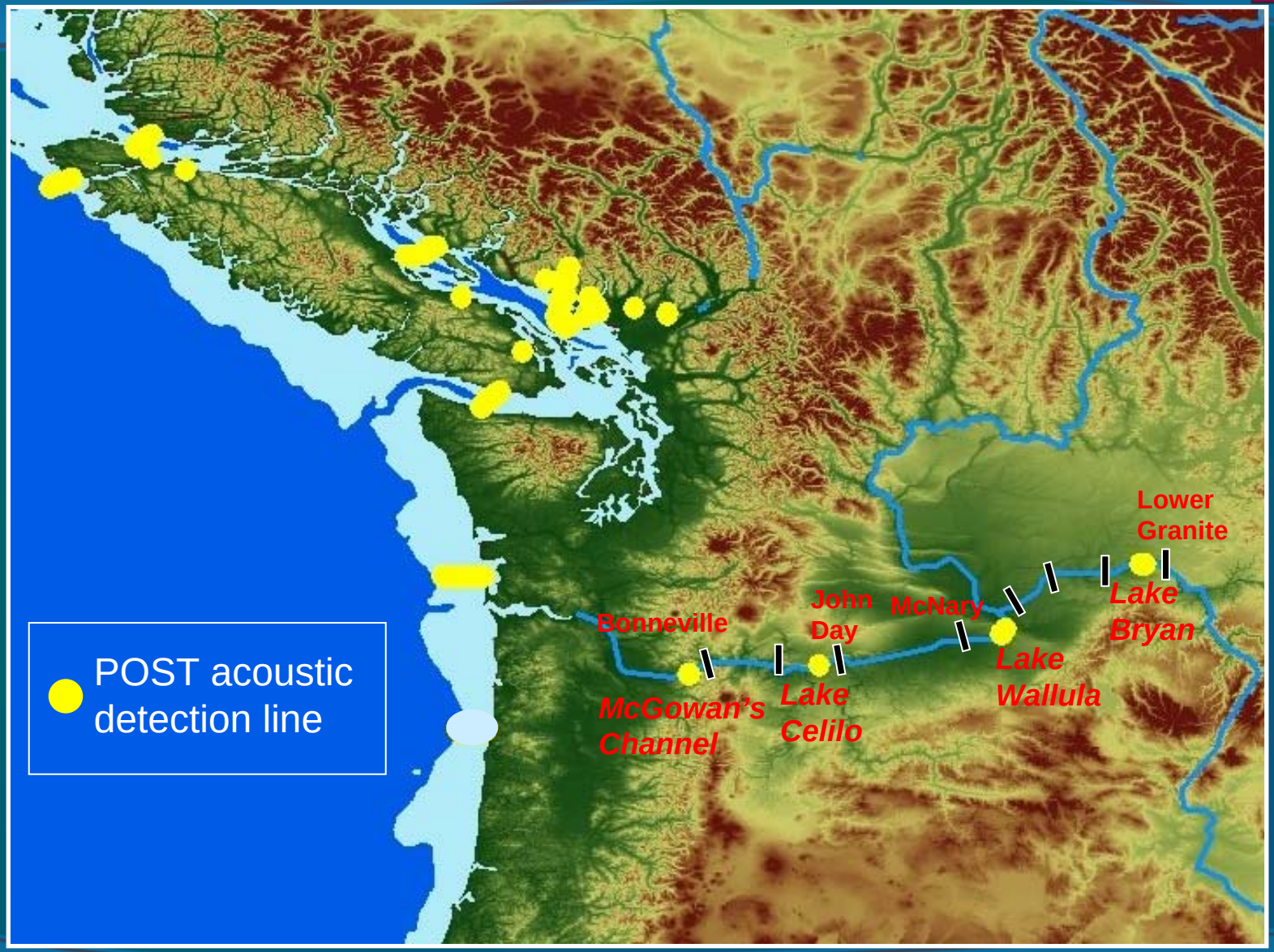

VEMCO
R3-UWM
ULTRASONIC RECEIVER
SN: 00070

Incremental New Designs-Improved Trawler Resistance??

2006 POST Array

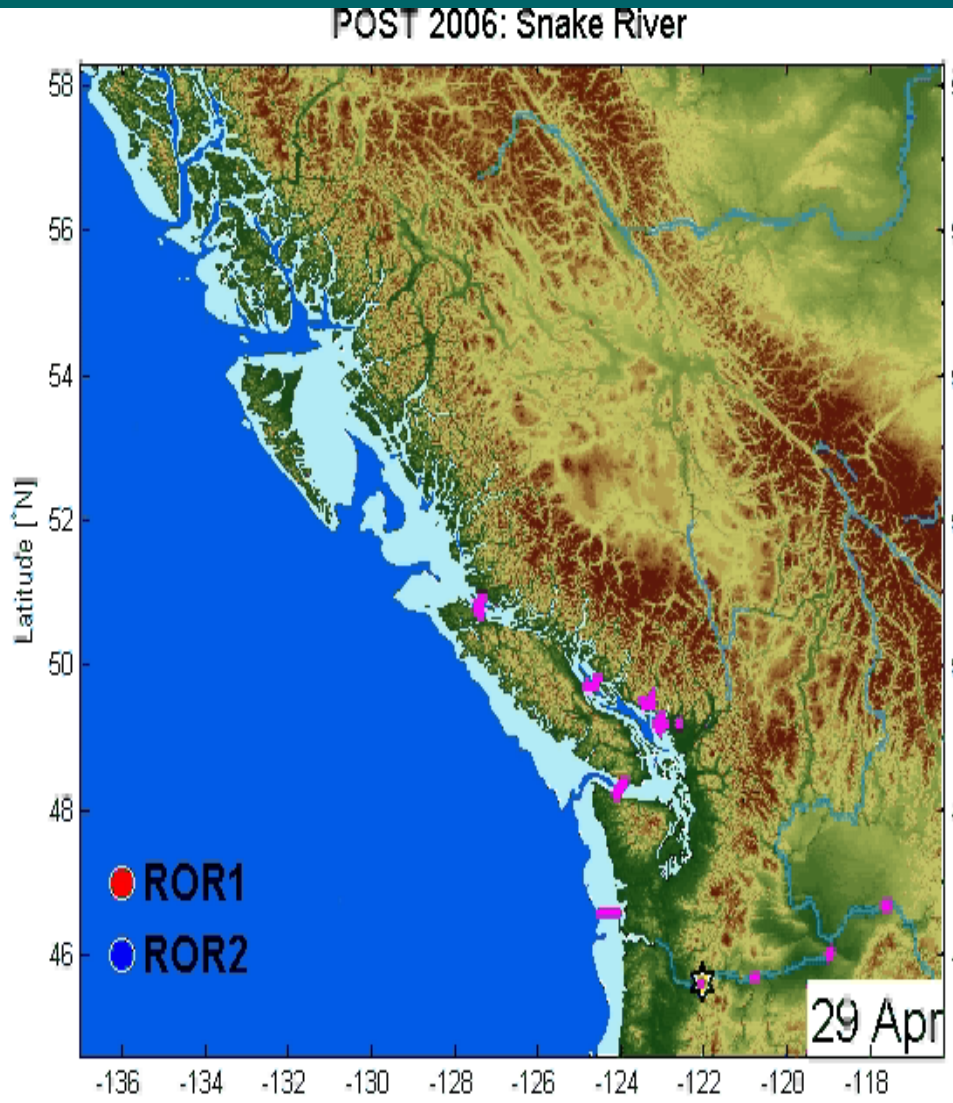


Columbia River POST Sub-Array

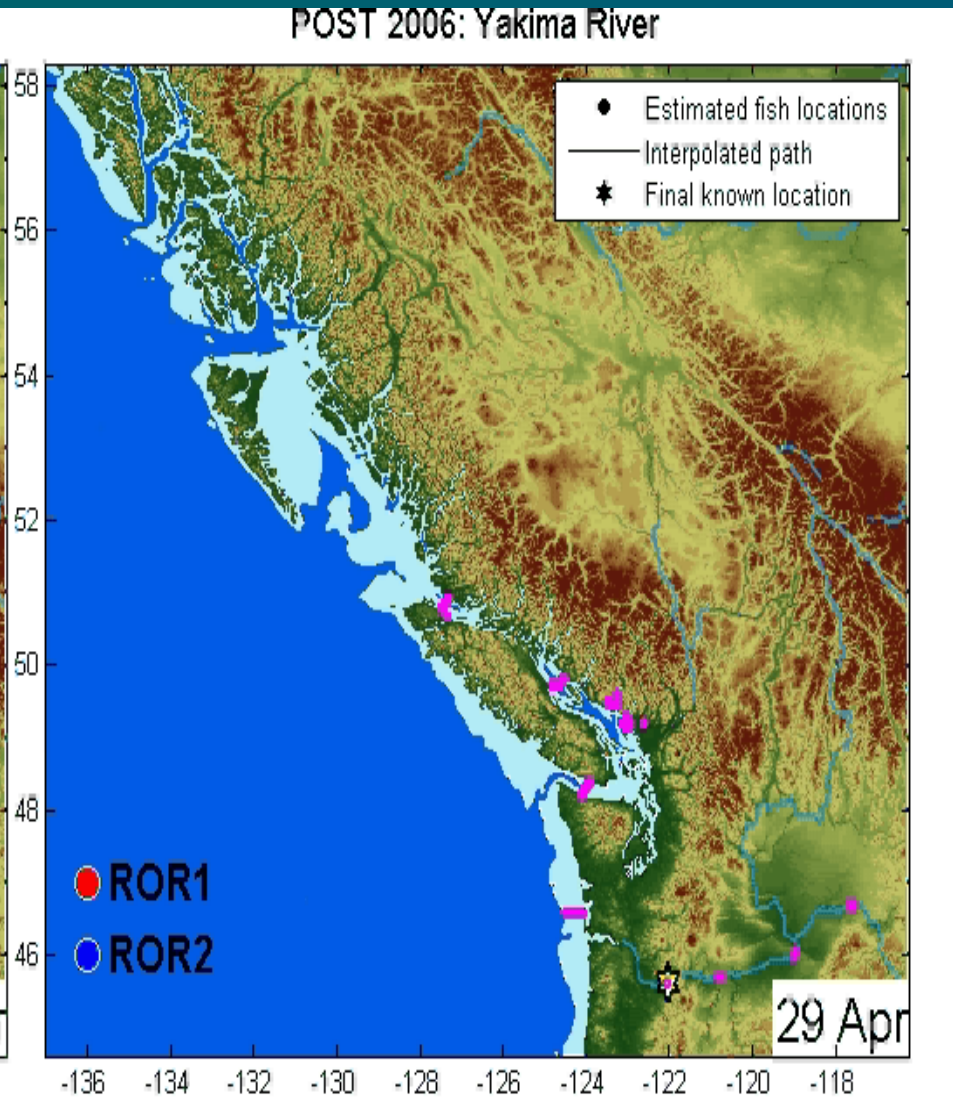


Results- Migration Rate

Snake



Yakima



Data Volumes & Error Rates

	2004	2005	2006
POST Array Total Detections	364,356	1,817,061	1,275,462
Accepted by First Scan	363,981	1,815,797	1,272,194
Rejected Detections	675	1,264	3,268
% "False Positives" (Max)	0.19%	0.07%	0.25%

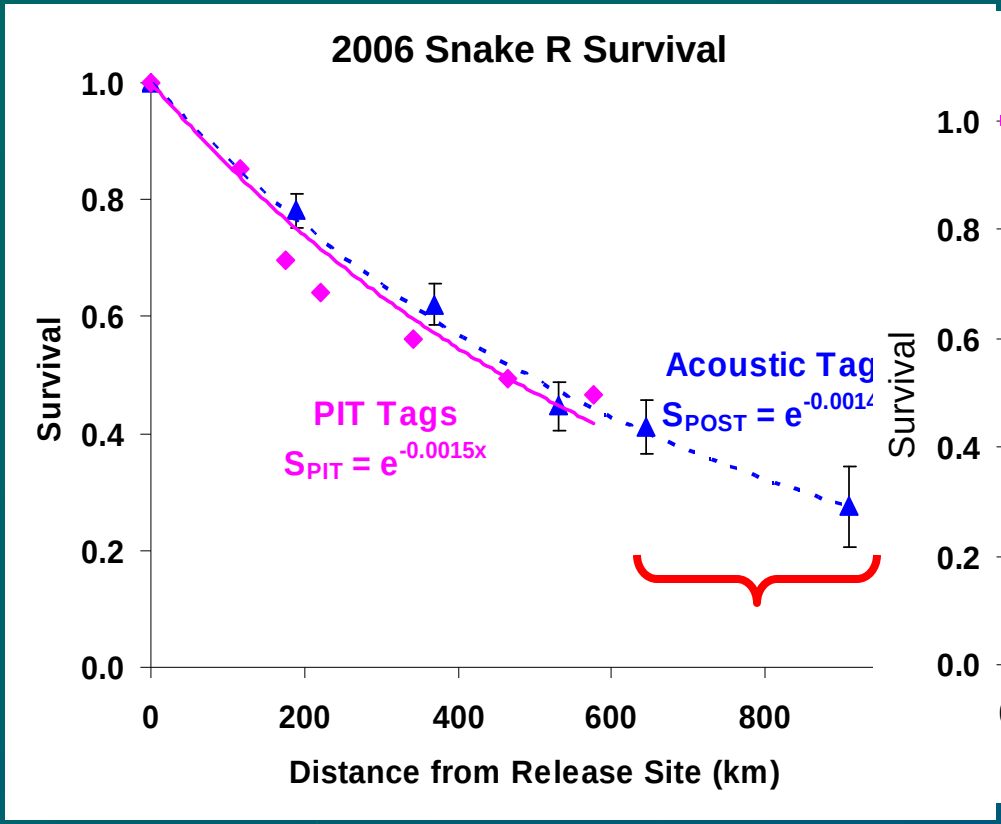
- Acceptance based on at least one pair of detections <4 minutes apart OR at least two pairs of detections <30 minutes apart

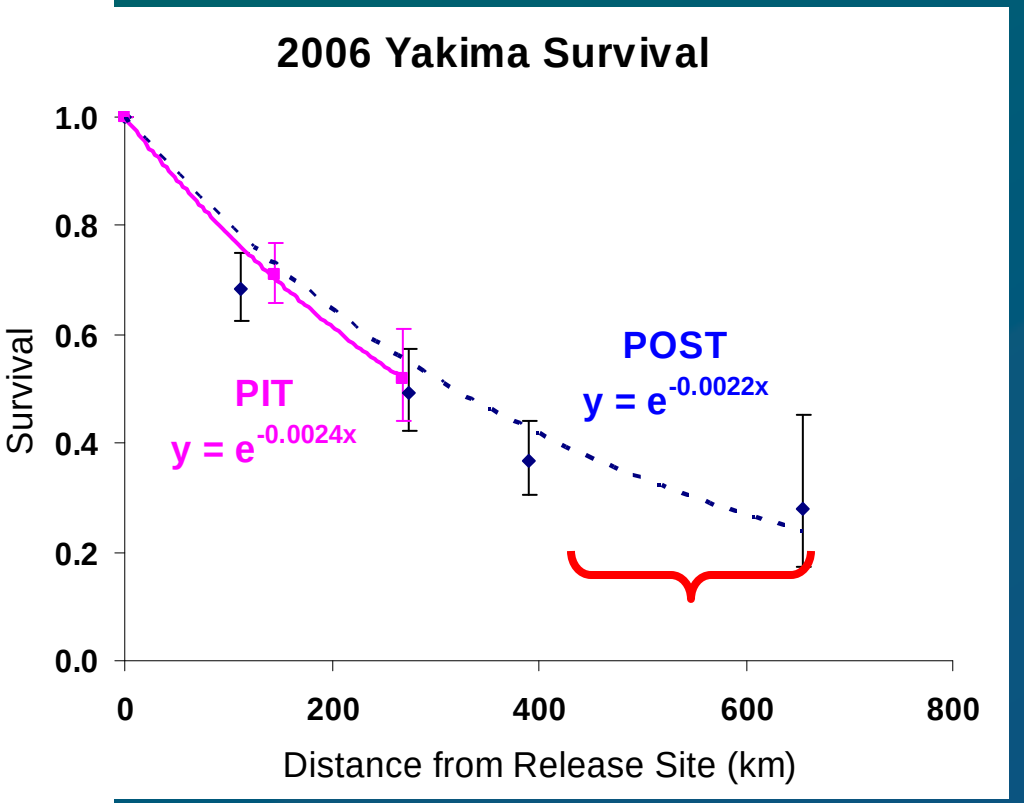
POST's Detection Efficiency & Survival Estimates-Snake R (Dworshak) 2006

Detection Site	Detection Rate	Standard Error	Reach Surv.	Standard Error
Lake Bryan (Snake R)	97%	1%	78%	3%
Lake Wallula	92%	3%	79%	4%
Lake Celilo	60%	6%	72%	5%
McGowan's Channel (Below Bonneville)	69%	7%	92%	9%
Willapa Bay	71%	15%	67% (28%)	17%
Lippy Point (NWVI)	unknown (~95%?)		5%	

*** Based on CJS Modelling Framework using Program MARK*

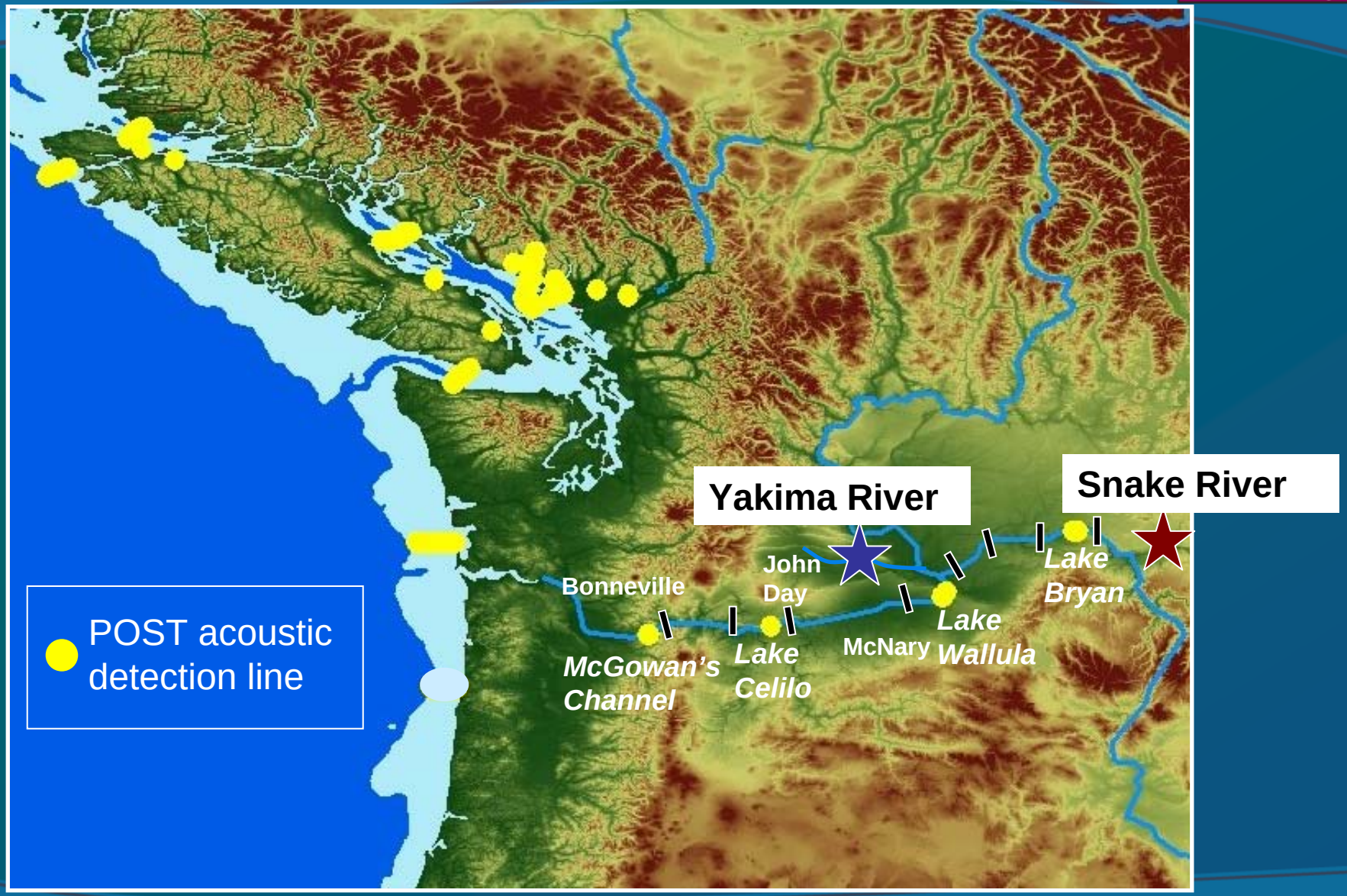
1. Tag Effects: Relative In-river Survival of PIT & POST Tags





**** POST's acoustic tags yielded the same survival rates as PIT tags in 2006, for the size range of smolts studied.***

2. Differential Mortality



Differential Mortality-2006

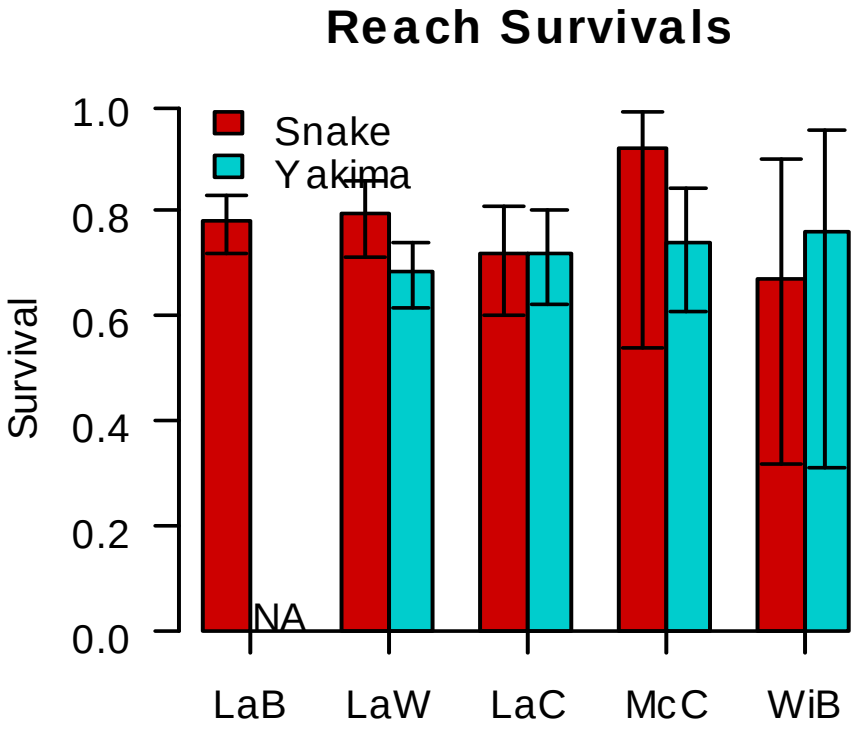
- Snake River- Dworshak Hatchery
  - Low adult return rate
    - 0.61%*
    - 8 yr average
    - LGR-LGR
  - 8 dams
  - 870 km to Columbia River mouth

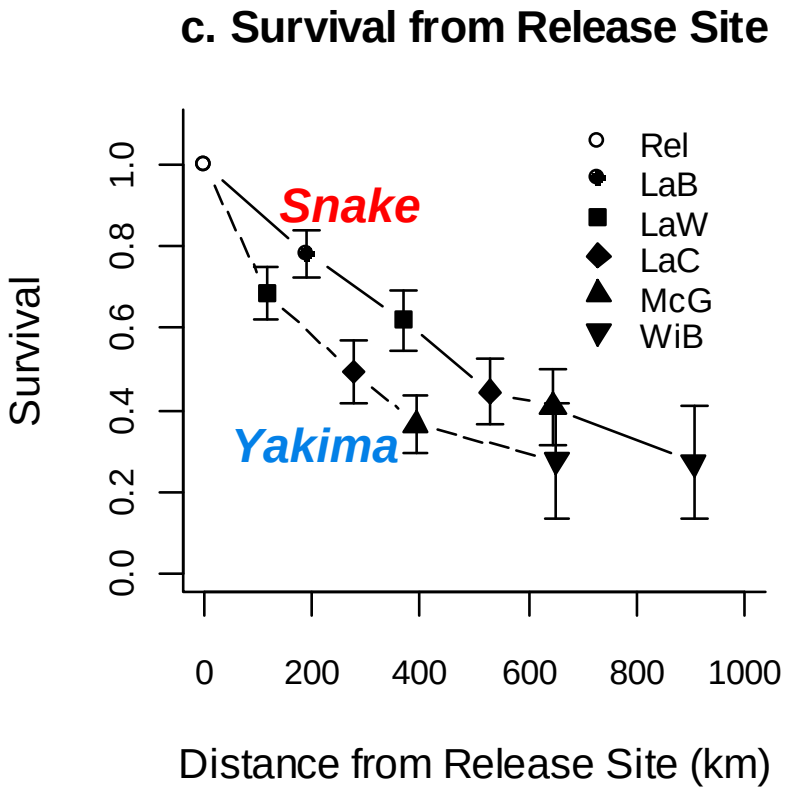
- Yakima River- Cle Elum Hatchery (CESRF)
  - Higher adult return rate
    - 2.8%*
    - 6 year average
    - Chandler-Yakima mouth
  - 4 dams
  - 615 km to Columbia River mouth

* Comparative Survival Study 2006 Annual Report

*Yakima/Klickitat Fisheries Project Monitoring and Evaluation 2006 Annual Report

Differential Mortality 2006 Results- Reach Specific Survivals



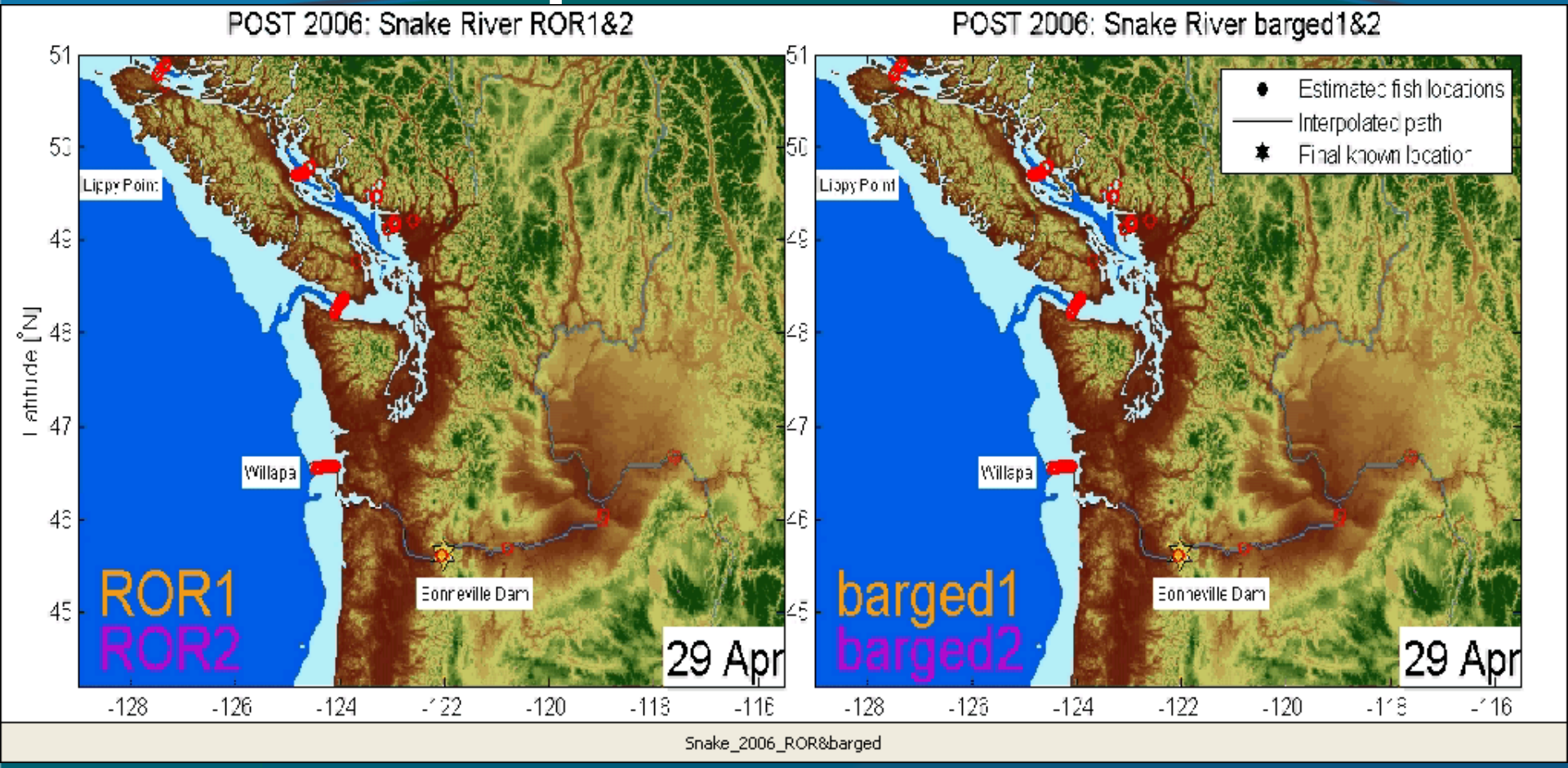


- *Survival between listening lines nearly identical for both populations*
- *When scaled by distance travelled, Snake R smolts had higher survival rates, despite historically much poorer SARs*

3) Transport

- Return of barged (transported) smolts doesn't seem to live up to it's promise
  - Protecting smolts from the 50% in-river mortality to Bonneville doesn't double adult returns– Why not??
  - Are smolts "disoriented" or otherwise compromised?

Snake R Spring Chinook: ROR v Transport Movements



Snake_2006_ROR&barged

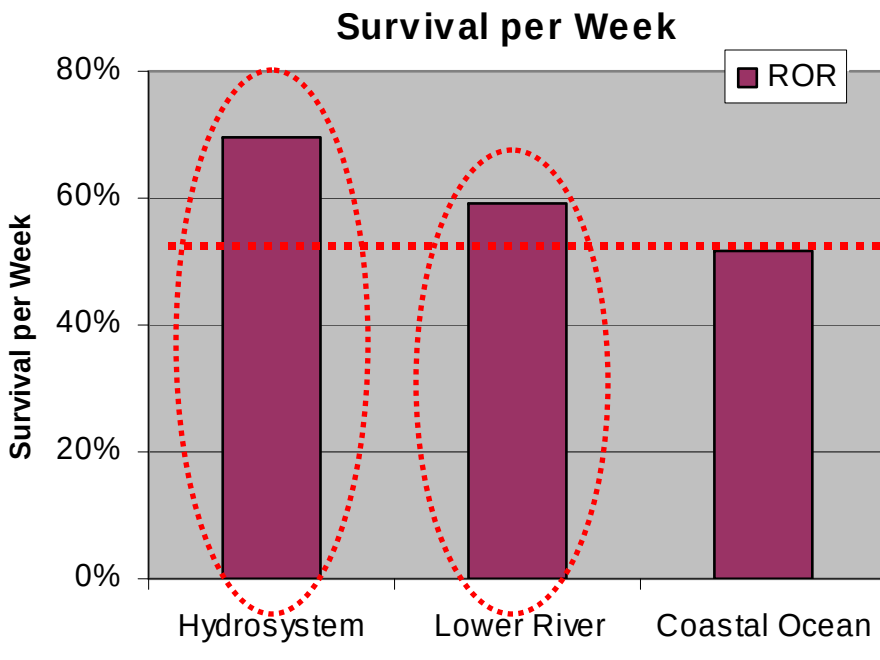
Transport v ROR Survival by Migration Segment- Overall

Detection Site	ROR Survival	ROR T_{Median}	Transport Survival	Transport T_{Median}
Snake R-Bonneville	41±5%	17.1 days	--	--
Bonneville-Willapa	67±17%	5.3 days	54±12%	6.03 days
Willapa-Lippy Point	5±2%	31.8 Days	14±4%	33.8 days

Reach specific survival calculated using CJS method & Program Mark; Lippy Point detection efficiency assumed to be 95%

Snake R Smolt Survival/Week - Transport v ROR by Migration Segment

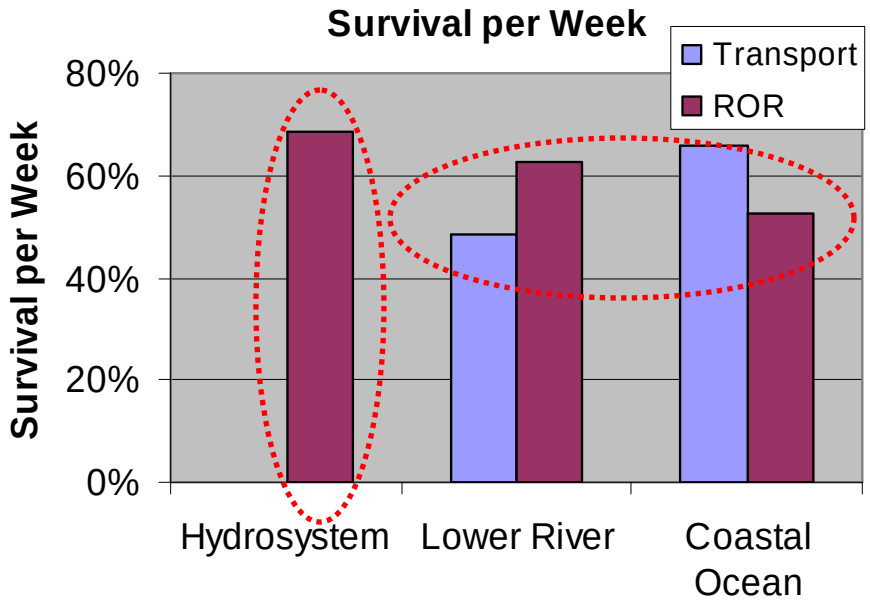
Survival Segment	ROR Survival (By Segment)	ROR Survival per Week
Snake R-Bonneville (Hydrosystem)	41%	69%
Bonneville-Willapa (Free-Flowing)	67%	59%
Willapa-Lippy Point (Ocean Shelf)	5%	52%



- Reach specific survival calculated using CJS method & Program Mark; Lippy Point detection efficiency assumed to be 95%

Transport v ROR by Migration Segment-Survival/Day

Survival Region	ROR Survival per Week	Transport Survival per Week
Snake R-Bonneville (Hydrosystem)	69% (62%-75%)	--
Bonneville-Willapa (Free-Flowing)	59% (24%-100%)	48% (24%-75%)
Willapa-Lippy Point (Ocean Shelf)	52% (23%-60%)	66% (55%-72%)



Survival ***rate*** of transported smolts about the same as that of the ROR smolts

Reach-specific survival calculated using Cormack-Jolly-Seber method & Program MARK; detection efficiency assumed to be 95%

Conclusions (1)

1. PIT & POST tags give indistinguishable survival estimates in 2006.
2. Measured in-river survival *rates* (S/km) appear to be the same above & below the hydrosystem
3. Delayed (differential) mortality was not expressed over the spatial extent of the POST array (Snake R to NWVI)
4. Survival *rates* of ROR & transported smolts are similar below Bonneville.

Conclusions (2)

1. Survival *rates* (per wk) were lower in the ocean than in freshwater

2. The inability of transport (barging) to improve adult returns likely occurs because transport moves smolts between two environments with roughly similar rates of survival

3. More complicated biological hypotheses involving delayed mortality due to stress from handling and transport may not be needed.

2007

1. 2007 results are currently under analysis.
2. They appear broadly similar, but there appears to be some problem with substantial dissapearance of tagged smolts before they reach the array
3. This could be caused by high initial mortality, residualization, tag failure, or a combination
4. As a result of reduced sample size, we think it is unlikely that 2007 results will disagree with 2006
5. 2007 sub-array at Astoria Bridge (RKm 10) performed well (~93% DE)


POST
PACIFIC OCEAN SHELF
TRACKING PROJECT


VANCOUVER AQUARIUM
MARINE SCIENCE CENTRE


OCEAN
TRACKING NETWORK

Thanks!


BPA


CENSUS
OF MARINE LIFE


Canada Foundation
for Innovation
Fondation canadienne
pour l'innovation


Gordon and Betty
MOORE
FOUNDATION
Creating positive outcomes
for future generations.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